

Local Area Networks (LANs)

1. For each of the following network topologies, discuss the consequences if a connection fails.
 - a. Bus topology
 - b. Star topology
 - c. Ring topology
 - i. **If one connection fails, the whole network fails.**
 - ii. **The other devices will still be able to send data through the hub; there will be no access to the device which has the failed connection to the hub.**
 - iii. **The failed connection may disable the whole network. Rings based on repeaters (as described in the text book) will fail completely. Other ring-based LAN technologies like FDDI will rap around either side of the break, re-forming the ring making them failure resistant.**
2. In CSMA, the use of p-persistent techniques reduces the probability of a collision.
 - a. What does CSMA stand for?
 - b. How does the CS part improve utilisation?
 - c. Describe the p-persistent technique.
 - d. What is the effect of increasing the value of p?
 - i. **Carrier Sense Multiple Access.**
 - ii. **In multiple access systems without Carrier Sense, if a host has a packet to send it sends it immediately, even if there is a transmission in progress. The time it takes for the colliding packets to clear is wasted. With Carrier Sense, this kind of collision will not occur and the packet currently in transit will get through.**
 - iii. **When a host has a packet to send, if the medium is not in use, it sends it. If it is in use the host monitors the medium and when it becomes available, it generates a random number and compare this with a pre-set parameter p. If the random number is smaller than p, then the packet is sent. If not, the host waits a preset time and repeats the cycle. If more than one host ready to send, this has the effect of staggering their attempts to send resulting in better throughput.**
 - iv. **A higher value of p means a host waiting to send a packet is more likely to do so when the medium become available. If multiple hosts are ready to send, it also means a higher chance that a collision will occur.**
3. A bridge and a switch can both reduce collision domains. Why would you choose a switch over a bridge? What can a bridge do that a switch cannot do? What does the term cut-through mean when applied to switches?

Switches are simpler devices than bridges so they are generally cheaper. They are most often used to provide bulk connectivity to workstations. This reduces the collision domain to one and results in high throughput.

A bridge can provide filtering facilities. They can also provide a remote extension to a LAN in a configuration known as a half-bridge.

A switch operating in cut-through mode reads enough of the packet header to decide which interface to forward the packet to and starts sending it even before the packet has been fully received. The alternative to cut-through mode is store-and-forward mode where the packet is fully received and CRC checked before forwarding.

4. A 80-station traditional Ethernet is divided into four collision domains. This means that a maximum of _____ stations contend for medium access at any one time. If Gigabit Ethernet is used, calculate the average bandwidth available for each host?
- a. 320
 - b. 80
 - c. 76
 - d. 20

Answer : d. 20 and $1000/20 = 50\text{Mbps}$

5. Where would you use a Layer 4 switch instead of a Layer 2 switch?

In large corporations, there are parts of the IT infrastructure that are in high demand. These include transaction processing servers, web site servers, financial processing and reporting systems and others. To satisfy demand, such applications are often delivered using multiple servers. Because Layer 4 switches can look into the application payload of a packet, they are used for load balancing requests to a single application and spreads them across multiple servers.

6. In the term CSMA/CD, the CD stands for Collision Detection. Explain how Collision Detection makes CSMA/CD better than CSMA.

If two hosts are operating in a CSMA environment and they both sense that the medium is free, they will both start transmitting and a collision will occur. Both hosts will continue to transmit to the end of their packet even though both packets have been corrupted.

In CSMA/CD, both hosts are required to listen to or monitor their transmission. If a collision occurs, they stop transmitting their packet and transmit a short “jamming” signal to alert all stations that a collision has occurred. This means the medium become free much sooner allowing other workstations (or the same two hosts) to contend for access.